Introduction to Botany. Lecture 4

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September 5, 2014

Outline

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Previous final question: the answer

What is molecular weight of sulfuric acid, H_2SO_4?

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What is molecular weight of sulfuric acid, H_2SO_4?

- H_2SO_4 weight $= 2 \times 1 + 32 + 16 \times 4 = 98$
- "98" what? Units of atomic mass, Dalton, "Da", 1/12 of carbon-12 (^{12}C) isotope weight.

Very basics of chemistry

- Atoms
  - Protons
  - Neutrons
  - Electrons
- Atomic weight
- Isotopes
- Elements
- Periodic table: rows and columns
- Chemical bonds: ionic, covalent, hydrogen
- Valence and group
- Molecules
- Molecular weight

Photosynthesis

Chemistry of life

Acids and bases

- Acids: take out H^+ (proton), like
  $HCl \rightarrow H^+ + Cl^-$
- Bases: take out OH^- (hydroxyl)
  $NaOH \rightarrow Na^+ + OH^-$

Molar mass and molar concentration

- Molar mass is a gram equivalent of molecular mass
- For example, molecular mass of salt (NaCl) is $23 + 35$[1] $= 58$ Da. We take “Da” out and replace it with “g” (grams). Therefore, 1 mole of salt is 58 g.
- Every mole contains $6.02214078 \times 10^{23}$ molecules (Avogadro’s number)
- Concentration is the density of dissolved substance
- In water solution, 1 M (1 molar) concentration of salt means that in 1 liter of distilled water 58 g of salt was diluted
- If we take half of this water, colcentration will still be 1 M whereas amount of diluted salt will decrease twice

[1] If we accept that atomic mass of chlorine in 35.

Concentration of protons, and pH and acidity

- If concentration of protons is 0.1 M (1×10^{-1}, 0.1 g of protons in 1 l of water), this is an extremely acidic solution
- In distilled water, concentration of protons is equal to 1×10^{-7} (0.0000001) M
- This is because water molecules can (rarely) dissociate: $H_20 \rightarrow H^+ + OH^-$
- pH of distilled water is equal to $-\log(10^{-7}) = -(-7) = 7$
- pH of the extremely acidic solution (first example) is 1

Photosynthesis

Molecules of life

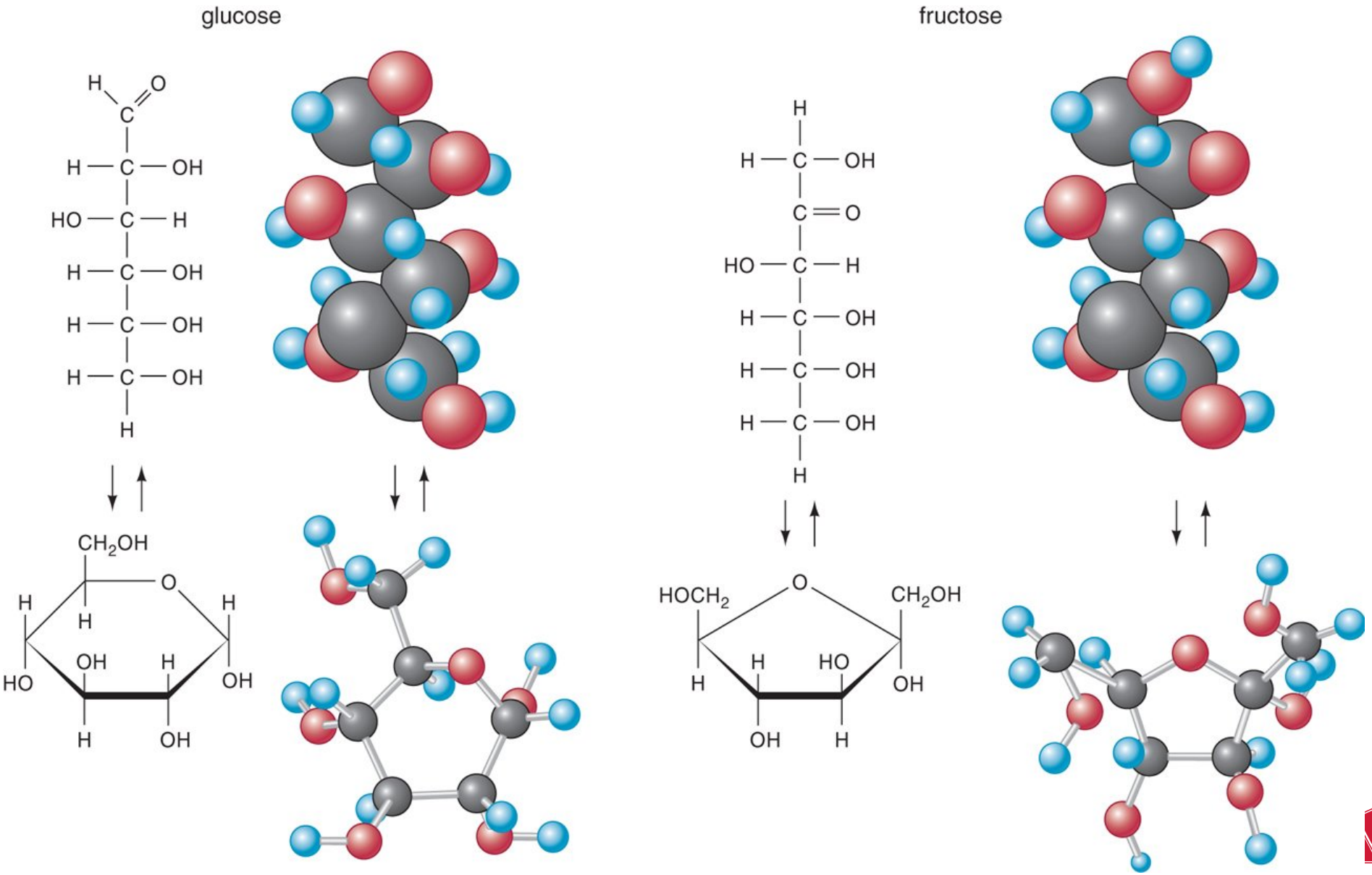
Organic chemistry: chemistry of carbon

- Carbon skeleton
- And H, O, N, P, S

Four types of biomolecules

- Lipids: hydrophobic
- Carbohydrates (sugars): multiple $-$OH groups
- Amino acids: N + C + O and hydrogen
- Nucleotides: cycle with nitrogen (heterocycle), sugar and phosphoric acid

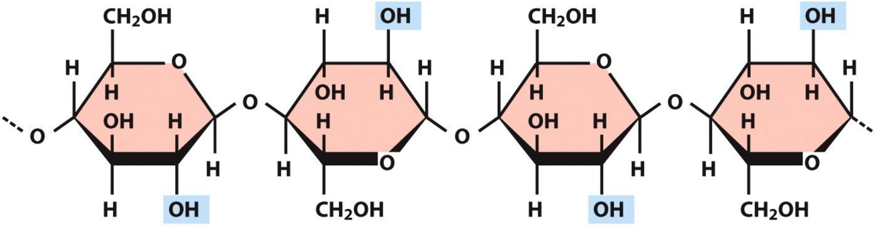
Carbohydrates



Organic polymers

- Polymeric carbohydrates: polysaccharides (like cellulose and starch)
- Polymeric amino acids: proteins
- Polymeric nucleotides: nucleic acids (DNA and RNA)

Cellulose



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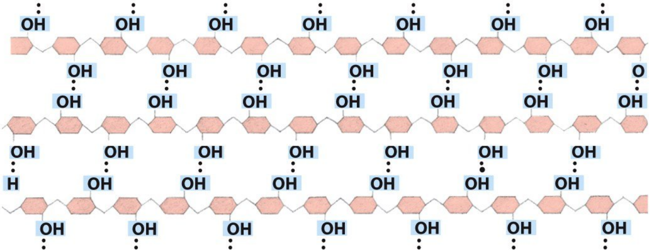

(b)

Final question (2 points)

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Name six biogenic elements.

Summary

- Main biogenic elements: C, H, O, N, P
- Most important bonds: covalent and hydrogen
- Most important monomers: lipids, carbohydrates, amino acids, nucleotides
- Most important polymers: polysaccarides, proteins, nucleic acids

For Further Reading

A. Shipunov.
Introduction to Botany [Electronic resource].
2010—onwards.
Mode of access:
http://ashipunov.info/shipunov/school/biol_154

Th. L. Rost, M. G. Barbour, C. R. Stocking, T. M. Murphy.
Plant Biology. 2nd edition.
Thomson Brooks/Cole, 2006.
Chapter 2.